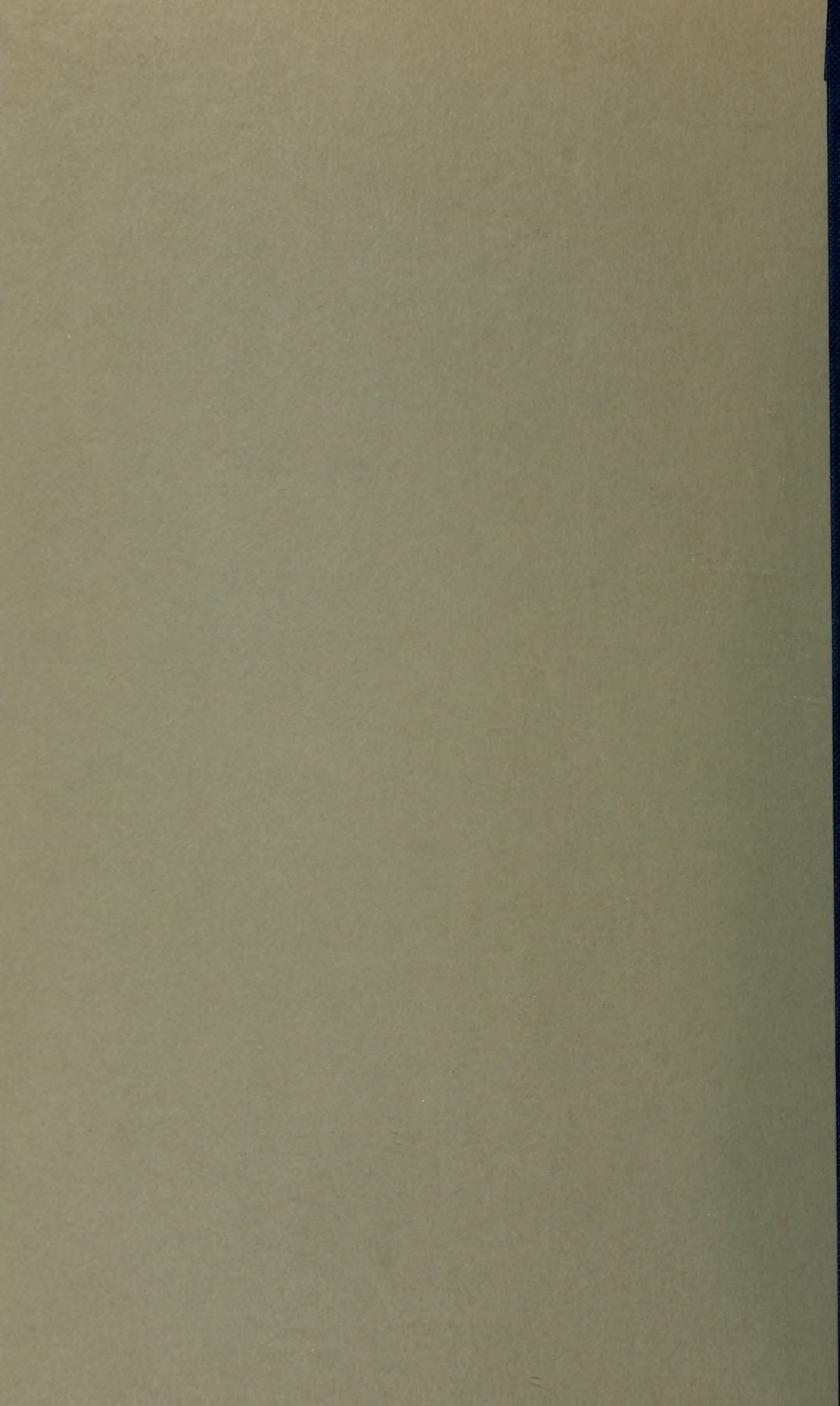


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Canada. Dept. of Agriculture. Entomology Research Institute
Report of the Dominion Entomologist

1950-11



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AUTHOR'S EDITION
FROM ANNUAL REPORT ON EXPERIMENTAL FARMS FOR THE YEAR 1910-11

CANADA
DEPARTMENT OF AGRICULTURE



REPORT OF THE DOMINION ENTOMOLOGIST
C. GORDON HEWITT, D.Sc.

FOR THE
YEAR ENDING MARCH 31
1911

OTTAWA
GOVERNMENT PRINTING BUREAU
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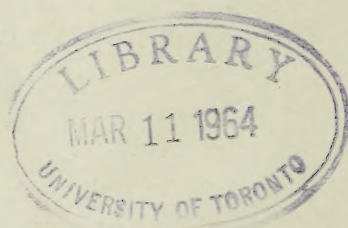
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REPORT OF THE DOMINION ENTOMOLOGIST

C. GORDON HEWITT, D.Sc.

OTTAWA, March 31, 1911.

Dr. WM. SAUNDERS, C.M.G.,
Director, Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to submit herewith my report of the work of the Division of Entomology, with an account of certain of the insects whose depredations received our attention and concerning which advice was given during the year ending March 31, 1911.

During the past year, which is the second succeeding the establishment of a separate Division and the re-organization of the work, there has been a very great increase in the executive and administrative work in addition to that carried out in the field. This increase is indicated to a certain extent by the correspondence of the Division, which was more than double that of the previous year; 2,476 letters were received and 3,845 letters were despatched.

The most important step which has been taken in Canada with a view to combating insect and other pests and plant diseases has been the enactment of 'The Destructive Insect and Pest Act.' With the rapid growth of the country, large quantities of trees, plants and other vegetation classed as 'nursery stock' are being brought into Canada annually from all countries of the world. The importation of such vegetation means the introduction into Canada of insects, pests and plant diseases of various kinds, some of which, such as the San José Scale and the Brown-tail and Gipsy moths, have already inflicted enormous losses as a result of their introduction and subsequent spread in the United States and Canada. In view of this danger, it was of the utmost importance that measures should be taken to prevent, so far as it is practicable, not only the further introduction of seriously injurious insects, pests, and plant diseases but also the spread of such insects and other pests already established in the Dominion. The Act and Regulations issued thereunder will be found in the following pages. The action at present taken in virtue of the powers given under the Act may be briefly summarized as: the fumigation with hydrocyanic acid gas at the fumigation stations established at certain ports on the frontier under the San José Scale Act of 1895, of stock liable to be infested with that scale; the inspection of vegetation from Europe, Japan and six of the New England States liable to be infested with the Brown-tail and Gipsy moths and certain other injurious insects; and the carrying on of extermination work in localities where pests, such as the Brown-tail moth and San José Scale are already established.

A new fumigation and inspection station has been erected at Vancouver, B.C., to meet with the increase which is taking place in the amount of nursery stock imported into British Columbia, and to enable us to inspect stock at the port of entry. This inspection is carried on in conjunction with that required by the British Columbia Board of Horticulture and I am pleased to record the satisfactory manner in which the work has been accomplished. A conference with the Provincial Board of

Horticulture at which the Minister of Finance and Agriculture of British Columbia was present, was held in Victoria, B.C., on October 10, 1910, when I explained the workings of the Destructive Insect and Pest Act.

The work against the Brown-tail Moth is described in the succeeding pages. The situation is more serious owing to the increase in the area infested in Nova Scotia, and the invasion of that portion of New Brunswick adjoining the infested region of the State of Maine. The Division has now undertaken, with the co-operation of the Departments of Agriculture in Nova Scotia and New Brunswick, a systematic campaign against the moth and a thorough scout of the infested district is being made. A study of the insect and its parasites is being carried on and I hope to arrange with Dr. L. O. Howard, Entomologist of the United States Department of Agriculture, for the importation of useful parasites.

In order to increase the opportunities for making the work of the Division more useful to the farmers and fruit growers in Canada, arrangements have been made through the willing co-operation of the heads of other Branches of the Department for the receipt of information concerning injurious insects through their crop reports and correspondence. The Dairy and Cold Storage Commissioner, Mr. J. A. Ruddick, is asking for such information concerning the depredations of fruit insects from the reporters of the fruit crop; the Census and Statistics Branch, through the co-operation of Mr. Blue, reports on insects affecting farm crops from the crop reporters of the Branch. The Veterinary Director General, Dr. J. G. Rutherford, has kindly issued to the Veterinary Inspectors of the Branch, a circular which I prepared in reference to obtaining information concerning species of insects affecting live stock. Mr. R. H. Campbell, Superintendent of the Forestry Branch of the Department of the Interior is also obtaining information from his field officers concerning outbreaks of forest insects. This co-operation is certain to result not only in making the work of the Division of value to a larger number of those whose interests are affected by injurious insects, but also in the accumulation of information and material which will be of very great value to us in our investigations. I should like again to express my indebtedness to these officers and also to those of the Provincial Governments for their co-operation and assistance from time to time.

Reference is made in the succeeding pages of this report to those insects whose injuries have been sufficiently serious to merit attention. Large numbers of the commoner insects are received with requests for advice as to their treatment. Attention should be called to the Narcissus Fly in British Columbia, an insect which has been imported on bulbs. The Larch Sawfly and the Spruce Budworm are being studied both in the field and in the laboratory and as these investigations are in progress, brief mention only is made of them. The control of these and other insects by means of their parasites is receiving special attention and it is becoming increasingly evident that in future we shall have to assist nature in re-adjusting the balance which man is constantly upsetting by cultivation and other means.

The following is a brief account of the visits which were made to the various provinces in connection with the work of this Division:—

At the beginning of the year (1910) I was in Nova Scotia in connection with the Brown-tail Moth extermination work, returning to Ottawa on April 6. From June 6 to June 25, I was absent in the United States to inquire into the extent of the danger existing with regard to the introduction of the Brown-tail and Gipsy Moths into Canada, and also to study the methods employed by the Federal and State Governments in combating these insects. The official and other entomologists at the following places were visited and consulted: New York Agricultural Experiment Station, Geneva, N.Y.; Cornell University, Ithaca, N.Y.; Department of Agriculture, Albany, N.Y.; New York where the State Entomologists of New Jersey and Massachusetts were met; Connecticut Agricultural Experimental Station and Yale University, New Haven, Conn.; Rhode Island Agricultural Experiment Station, Kingston, R.I.; Bussey Institution and Harvard University, Cambridge, Mass.; State Forestry Depart-

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ment, Boston, Mass.; Gipsy Moth Parasite Laboratory, Melrose Highlands, Mass.; New Hampshire Agricultural Experiment Station, Durham, N.H.; Department of Agriculture, Augusta, Me.; Maine Agricultural Experiment Station, Orono, Me.; Vermont Agricultural Experiment Station, Burlington, Vt. I should like to express again my sincere thanks to those of my fellow-workers whom I met, for their kindness and help. One result of the inquiries made during the visits was the passing of a regulation by Order-in-Council, under the Destructive Insect and Pest Act, providing for the inspection of nursery stock from the States of Vermont, New Hampshire, Maine, Massachusetts, Connecticut and Rhode Island for the Brown-tail and Gipsy Moths.

The annual meeting of the Canadian Horticultural Association at St. Catharines, Ont., was attended on August 11 at the request of the Association to explain the Destructive Insect and Pest Act as affecting the importation of florist stock into Canada. As the result of a consideration of their representations some amendments in the regulations were made to obviate hardships which might otherwise occur.

On September 19 I left Ottawa for the western provinces and British Columbia in connection with the inspection and fumigation work of the Division and to discuss with the provincial Departments of Agriculture means of co-operation in respect of controlling injurious insects and reporting their occurrences, etc. In so wide a country such co-operation is essential and I am convinced that the meetings which I had will help to forward the work. By arrangement with the provincial and civic Medical Officers of Health I lectured in the following cities on the relation of house flies to public health: Winnipeg, Man.; Regina and Saskatoon, Sask.; Edmonton, Alta.; Vancouver, B.C.; and before the Natural History Society of British Columbia in Victoria, B.C. On Vancouver Island, the outbreak of the Spruce Budworm was again investigated, and I travelled as far as Nanaimo. This year I visited the Okanagan Valley and again passed through the Kootenay region. After visiting Lethbridge, Alta., I returned direct to Ottawa, arriving back on October 29.

The annual meeting of the Entomological Society of Ontario was attended on November 3 and 4. Mr. Gibson also attended and accounts of our work were given. On November 28 a public lecture was delivered at Halifax, N.S., on the Tussock and Brown-tail Moths, at the request of the citizens. I addressed the annual meeting of the Nova Scotia Fruit Growers' Association at Windsor, N.S., on November 29 and the annual meeting of the Prince Edward Island Fruit Growers' Association at Charlottetown, P.E.I., on December 1. After visiting Truro and Quebec I addressed the annual meeting of the Quebec Pomological Society at St. Hyacinthe, P.Q., on December 6.

The Canadian Forestry Association convention, which was held at Quebec on January 18 and 20, was attended and I delivered an illustrated lecture on the Spruce Budworm and Larch Sawfly. After the convention I visited the Chicoutimi region to study the outbreak of the Spruce Budworm, and afterwards, on January 31 to February 2, the depredations of the same insect were investigated in the Rouge River in the neighbourhood of St. Jovite and Trembling Mountain, P.Q., on which visit I was accompanied by Mr. G. C. Piché, Chief Forestry Engineer of the Forest Service of Quebec.

Full use has been made of the collections of Canadian insects belonging to the Division, by collectors, teachers and students of entomology in all parts of Canada. Slowly but surely we are arranging and building up the collection. I must again sincerely thank all those specialists in Canada and the United States, especially Dr. Howard and his staff of the Bureau of Entomology, at Washington, D.C., for their oft repeated kindnesses in determining material for us. Many of the injurious insects are being mounted in Riker cases for exhibition purposes and they have already proved of considerable assistance in educational work.

During the summer months, from May to October, with occasional visits in the winter, the work of spraying in keeping in order the orchards of the Indian reserves in British Columbia has been carried on by the Division for the Department of Indian

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Affairs. Mr. Tom Wilson has been in charge of the work, and in addition to the actual work in the orchards he visited many of the schools where practical demonstrations on methods of orchard cultivation were given to the children. I am pleased to record the satisfaction that this work is giving, especially to those settlers whose fruit growing was previously jeopardized somewhat by the condition in which many of the neighbouring Indians maintained their orchards. The work is also proving beneficial to the Indians, a number of whose orchards are producing excellent fruit. Its further extension will be of undoubted value to the industry in the province.

I am pleased to have this opportunity afforded me of gratefully acknowledging the help and work of my Chief Assistant, Mr. Arthur Gibson. Mr. R. C. Treherne, B.S.A., and Mr. George E. Sanders, B.S.A., have been appointed as field officers in connection with the Brown-tail Moth inspection and extermination work, which duties they are carrying on in a most satisfactory manner. Of their work and of that of my secretary, Mr. J. A. Letourneau, I wish to express my cordial appreciation.

The war against insect pests becomes annually more serious. No group of animals affects man in so great a variety of ways. Their prevention, eradication and control make increasing demands for a more thorough knowledge of their life histories, habits and natural enemies, which can only be gained by careful study both in the laboratory and in the field. It is becoming more generally realized that methods to prevent and reduce losses entailed by insect attacks must necessarily accompany any system of soil culture, or utilization, whether it be on the farm, in the orchard or in the forest.

I have the honour to be, sir,

Your obedient servant,

C. GORDON HEWITT,

Dominion Entomologist.

DIVISION OF ENTOMOLOGY.

THE DESTRUCTIVE INSECT AND PEST ACT, 1910.

In May, 1910, Parliament passed 'An Act to prevent the introduction or spreading of Insects, Pests and Diseases destructive to vegetation.' The danger of the introduction of injurious insects, pests and plant diseases is probably greater in Canada than in any other country. This is due to the fact that, owing to the rapid development and opening up of the country, a large amount of vegetation of all kinds, trees, shrubs, seedlings, etc., is imported into Canada from countries in various parts of the world. All this vegetation, collectively termed 'nursery stock' is liable to be infested with insects and other pests and diseases which do not occur in Canada. Introduced in this manner, however, in many instances they become established. The seriousness of such an establishing of an introduced insect in a new country is enormously increased by the fact that their means of control in their native country, namely, their native parasites, are not usually brought with them. Their tendency, therefore, is to increase as we see the Gipsy and Brown-tail Moths increasing in the United States. It is estimated that 50 per cent of the insect pests in the United States are introduced insects. In Canada a number of introduced insects have already established themselves and in certain cases have resulted in great losses. The San José Scale, originally introduced into the United States, was first recorded in Canada about 1894; the Brown-tail Moth introduced into the State of Massachusetts about 1890 from Europe, was discovered in Nova Scotia in 1907; the Narcissus Fly, which would appear to be a native of Europe, has been introduced into British Columbia on bulbs from Holland. Numerous other instances of the introduction of injurious insects into Canada and their subsequent spread might be adduced, indicating this danger to which we are exposed.

The introduction of the San José Scale and the previous experience of its destructive powers in the United States were responsible for the passage of the San José Scale Act in 1898, which prohibited the importation of nursery stock from countries in which this scale occurred. In 1901 by an Order-in-Council, fumigation stations were established at six ports through which stock was allowed to enter at certain periods of the year after having been fumigated with hydrocyanic acid gas. Certain classes of stock, not likely to be infested with San José Scale, were exempt from fumigation,

Except for this power to fumigate certain classes of nursery stock at six of the ports of entry, the Federal Government had no authority to take action to prevent the introduction of further insect pests and the spreading of these, or of pests already in Canada. In 1909, winter webs of the Brown-tail Moth were found in Canada and the United States in shipments of nursery stock from France. As this insect had already established itself in Nova Scotia, it was important that the Minister should have the necessary powers to prevent the introduction of the pest into those parts of Canada not already infested. Accordingly, the Destructive Insect and Pest Act was passed, under which regulations could be issued providing for the prohibition of entry, fumigation on entry or inspection subsequent to entry, of nursery stock and defining other conditions under which nursery stock and other vegetation might be introduced into Canada. Regulations were passed by Order-in-Council in virtue of provisions of section 3 of the Act on May 1, and July 27, 1910. These regulations were rescinded by regulations passed by Order-in-Council on February 27, 1911.

The text of the Act and the regulations issued thereunder are as follows:—

THE DESTRUCTIVE INSECT AND PEST ACT.

AN ACT TO PREVENT THE INTRODUCTION OR SPREADING OF INSECTS, PESTS AND DISEASES
DESTRUCTIVE TO VEGETATION.

(9-10 Edward VII., Chap. 31, assented to May 4, 1910.)

His Majesty by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:—

1. This Act may be cited as *The Destructive Insect and Pest Act*.
2. In this Act, unless the context otherwise requires, 'the Minister' means the 'Minister of Agriculture.'
3. The Governor in Council may make such regulations as are deemed expedient to prevent the introduction or admission into Canada, or the spreading therein, of any insect, pest or disease destructive to vegetation.
4. Such regulations may provide:—
 - (a) for the prohibition generally, or from any particular country or place, of the introduction or admission into Canada of any vegetable or other matter likely to introduce any such insect, pest or disease;
 - (b) the terms or conditions upon, and the places at which any such vegetable or other matter may be introduced or admitted into Canada;
 - (c) for the treatment and manner of treatment to be given to any vegetation, vegetable matter or premises in order to prevent the spreading of any such insect, pest or disease, and may prescribe whether such treatment shall be given by the owner or by a person appointed for such purpose;
 - (d) for the destruction of any crop, tree, bush or other vegetation or vegetable matter or containers thereof infested or suspected to be infested with any such insect, pest or disease;
 - (e) for the granting of compensation for any such crop, tree, bush or other vegetation or containers thereof so destroyed, such compensation not to exceed two-thirds of the value of the matter so destroyed and to be granted only by the Governor in Council upon the recommendation of the Minister.
 - (f) for the prohibition of the sale of any vegetable matter infected with any such insect, pest or disease;
 - (g) that the occupier of the premises on which is discovered any such insect, pest or disease shall forthwith notify the Minister and shall also send specimens of any such insect, pest or disease;
 - (h) for the confiscation of any vegetable matter and the container thereof, if any, in respect of which a breach of this Act, or any regulation made thereunder is committed and generally for any other purpose which may be deemed expedient for carrying out this Act, whether such other regulations are of the kind enumerated in this section or not.
5. The Minister may appoint inspectors and other officers for carrying out this Act and the regulations thereunder.
2. Such appointments, if not confirmed by the Governor in Council within thirty days of the date thereof, shall lapse and cease to be valid.
6. Any inspector or other officer so appointed may enter any place or premises in which he has reason to believe there exists any such insect, pest or disease, and may take specimens thereof and also any vegetable matter infested or suspected of being infested therewith.
7. The Minister, upon the report of any inspector setting forth a reasonable belief of the existence of any such insect, pest or disease in any area defined in such report, may prohibit the removal from such area or the movement therein of any vegetation,

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vegetable or other matter which, in his opinion, is likely to result in the spread of such insect, pest or disease.

8. Every person who contravenes any provision of this Act, or any regulation made thereunder, shall be liable, upon summary conviction, to a fine not exceeding one hundred dollars, or to imprisonment for a term not exceeding six months, or to both fine and imprisonment. Any vegetable or other matter imported or brought into Canada contrary to this Act, or to any regulation made thereunder, shall be forfeited to the Crown.

9. Every Order-in-Council and regulation made under this Act shall be published in *The Canada Gazette*, and shall be laid, by the Minister, before Parliament within fifteen days after the commencement of the then next session.

10. *The San José Scale Act* is repealed.

Regulations issued under the Destructive Insect and Pest Act.

(By Order-in-Council of February 27, 1911).

1. 'Inspector' means a person appointed for carrying out the provisions of the Destructive Insect and Pest Act and the regulations made thereunder.

2. No tree, plant or other vegetation or vegetable matter infested with any of the insects, pests or diseases to which this Act applies, shall be imported into Canada, except as hereinafter provided.

3. Nursery stock, including all trees, shrubs, plants, vines, grafts, scions, cuttings or buds which are not hereinafter exempted, entering Canada shall be imported only through the ports and during the periods respectively hereinafter mentioned, that is to say:—

Vancouver, B.C., from October 1 to May 1.

Niagara Falls, Ont., from October 1 to May 15.

Winnipeg, Man., and St. John, N.B., from March 15 to May 15, and from October 7 to December 7.

Windsor, Ont., and St. Johns, P.Q., from March 15 to May 15, and from September 26 to December 7.

At these points of entry, the importations shall be fumigated in the fumigation houses provided for that purpose, and a certificate of fumigation will be issued, without which no stock may be taken out of bond.

Importations by mail shall be subject to the same regulations.

All nursery stock originating in Japan or in any one of the states of Vermont, New Hampshire, Maine, Massachusetts, Connecticut and Rhode Island, six of the United States of America, shall, after fumigation, be subject to inspection as provided by section 6 of these regulations.

Provided, however, that the following vegetation and florist's stock shall be exempt from fumigation and may be imported at any season of the year and through any port without inspection:—

(a) Greenhouse-grown plants, including roses in foliage which have been grown in pots up to three inches in diameter but not larger. A certificate that the plants have been grown under glass must accompany the invoice and shall be signed by the consignor.

(b) Herbaceous perennials (the stems of which die down in winter) such as perennial phlox, pæonies, sunflowers, etc.

(c) Herbaceous bedding plants (such as geraniums, verbenas, pansies, etc.)

(d) Bulbs and tubers (such as hyacinths, lilies, narcissi and other true bulbs and also the tubers of dahlias, irises, etc.).

(e) Cottonwood or Necklace Poplar (*Populus deltoides*) when shipped from and grown in Dakota or Minnesota, two or the United States of America.

4. The port by which it is intended that the nursery stock shall enter shall be clearly stated on each package, and all shipments made in accordance with these regulations will be entirely at the risk of the shippers or consignees, the government assuming no responsibility whatever.

5. All persons importing nursery stock, except such as is exempt from fumigation or inspection under section 3 of these regulations, shall give notice to the Dominion Entomologist, Experimental Farm, Ottawa, within five days of despatching the order for the same, and they shall again notify the Dominion Entomologist on the arrival of the shipment in Canada.

Notice shall also be given to the Dominion Entomologist by all transportation companies, custom house brokers or other persons importing or bringing into Canada nursery stock that is subject to inspection as hereinafter provided, immediately such a consignment is received by them. Such notice shall include the name of the consignor and the consignee, the points of origin and destination, the name of the company carrying the nursery stock, as well as the nature, quantity and origin of the same.

6. Nursery stock, not including such stock as is exempt under section 3 of these regulations, originating in Europe, shall be imported only through the ports and during the periods specified under section 3 for stock requiring fumigation, with the addition of the ports of Halifax, N.S., Sherbrooke, P.Q., and Montreal, P.Q., through which ports such European stock may enter from September 15 to May 15. Such European nursery stock, and such other imported vegetation as the Minister may determine, entering Canada, shall be exempt from fumigation, but shall be inspected either at the port of entry or at its destination to which it may be allowed to proceed, but in the latter case it must not be unpacked except in the presence of an inspector.

7. If, on inspection, nursery stock or other vegetation or vegetable matter is found to be infested with any of the insects, pests or diseases hereinafter specified, it shall be destroyed to the extent deemed necessary by the inspector and in his presence. All cases, packages, and packing in which such stock has been contained shall also be destroyed in the same manner.

8. Any inspector entering any lands, nursery or other premises where there is reason to believe that any of the insects, pests or diseases hereinafter specified are or may be present, shall give instructions for the treatment or destruction of any tree, bush, crop or other vegetation or vegetable matter or the containers thereof, which may be found or suspected to be infested with any of the insects, pests or diseases hereinafter specified, and such instructions shall be carried out by the owner or the lessee of the infected or suspected vegetation, vegetable matter or containers thereof, and such remedial treatment shall be carried out and continued until the insect, pest or disease shall be deemed by the inspector to have been exterminated.

9. Compensation, not exceeding two-thirds of the value assessed by the inspector, of the vegetation or vegetable matter or containers thereof destroyed by the instructions of an inspector, shall be granted by the Governor in Council upon the recommendation of the Minister.

10. It shall be illegal to sell, offer for sale or in any way dispose of or receive any trees, shrubs or other plants, vegetable matter or portions of the same, if the same are infested with any of the insects, pests or diseases hereinafter specified.

11. The owner, occupier or lessee of any premises or place where any of the insects, pests or diseases specified herein shall be found, shall immediately notify the Minister, and shall also send to him specimens of such insects, pests or diseases.

12. The destructive insects, pests or diseases to which the said Act shall apply shall include the following:—

The San José Scale (*Aspidiotus perniciosus*).

The Brown-tail Moth (*Euproctis chrysorrhæa*).

The Woolly Aphis (*Schizoneura lanigera*).

The West Indian Peach Scale (*Aulacaspis pentagona*).

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- The Gipsy Moth (*Porthetria dispar*).
 Potato Canker (*Chrysophlyctis endobiotica*).
 Parasitic diseases affecting potatoes externally or internally.
 Branch or Stem Canker (*Nectria ditissima*).
 Gooseberry Mildew (*Sphaerotheca mors-uvæ*).
 White Pine Blister Rust (*Peridermium strobi*).

13. The importation of potatoes into Canada from Newfoundland or the Islands of St. Pierre or Miquelon is prohibited.

14. The Minister may, upon special request to that effect, authorize the importation into Canada of any insect, pest or disease hereinafter specified, but for scientific purposes only.

15. The regulations made under the *San José Scale Act* are repealed.

BROWN-TAIL MOTH.

The work directed against the Brown-tail Moth (*Euproctis chrysorrhæa*) has again comprised the inspection of all shipments of European and certain other classes of imported nursery stock for the winter webs or nests of the insects, and, in addition, the inspection of the areas infested or liable to be infested in Nova Scotia and New Brunswick.

INSPECTION OF IMPORTED NURSERY STOCK.

The inspection of shipments of European nursery stock was concluded at the end of May last (1910), and as it was in progress at the close of the previous fiscal year, it was impossible to report upon it at an earlier date. In eastern Canada over two and a half million plants and trees were examined and 310 winter webs of the Brown-tail Moth were found. They were distributed on the different species of plants as follows:—

Apple.. . . .	234
Pear.. . . .	40
Plum.. . . .	19
Ornamentals.. . . .	5
Spiræa	5
Cherry.. . . .	4
Quince.. . . .	2
Berberis.. . . .	1

All the infested stock was of French origin and the webs were found in the following proportions on the stock of the different shippers:—

Messrs. Choplin, Maze.. . . .	165
“ L. Courant, Angers.. . . .	57
“ L. LeRoy, Angers	48
“ V. LeBreton, Angers	23
“ Detrichi, Angers.. . . .	10
“ Colombe, Senault & Huet, Calvados	4
“ Andre LeRoy, Angers.. . . .	3

These figures do not include the stock imported into British Columbia which was inspected by the Inspector of Fruit Pests of the province and his officers.

A letter was sent to each of the above nurserymen calling their attention to the seriously infested nature of their stock, and we understand from them and from Dr. L.

O. Howard, Entomologist of the United States Department of Agriculture, who visited Angers, that efforts are being made by the nurserymen and by the French Government to institute a better system of nursery inspection than has existed hitherto. This inspection in Canada is now being carried on under the Destructive Insect and Pest Act. The scarcity of nests in the French shipments during the present season would indicate either that greater care is being taken by the nurserymen or that the outbreak of the insect in the localities in which the nurseries are located was less severe last season. It is probable that the scarcity of nests is due to both causes.

FIELD INSPECTION IN NOVA SCOTIA.

As in the year following the first discovery of the Brown-tail Moth in Kings County, Nova Scotia, in 1907, Prof. M. Cumming, Secretary for Agriculture for the province arranged for the inspection of the infested regions, and the destruction of the winter webs was carried on by Messrs. H. G. Payne and H. R. Brown. Their work was supplemented by Mr. G. H. Vroom, Dominion Fruit Inspector. Their work was confined to a careful survey of the orchards and adjoining wild thickets, and the collection of the winter webs. Altogether 1,484 winter webs were destroyed, which is an increase over the number destroyed in 1909, when over 800 nests were destroyed.

The following list of localities and numbers of winter webs which were destroyed in the same, which has been supplied by Mr. Vroom, indicates the degree of infestation in the different localities in the years 1909-1910.

Bridgetown.	344
Deep Brook.	417
Bear River.	390
Nictaux.	235
Middleton.	40
Smith's Cove	24
Laurencetown	16
Paradise	8
Clements Port	5
Round Hill	3
Lequille	2
Total	1,484

It will be seen from the above that the region which was inspected during the winter of 1909-10, was about 50 miles in extent. Mr. Vroom reported that the webs were larger and contained more caterpillars than those collected during the previous winter. The presence of a large number of webs at Nictaux indicates an increase in that region where only two or three webs had been obtained previously.

During the past year the Federal Department of Agriculture took over the responsibility for the conduct of the Brown-tail Moth extermination work in the province with the co-operation of the Provincial Department of Agriculture who are continuing, in co-operation with our officers, work of the same extent as in the previous year. The federal and provincial officers are working together under our direction and are divided into two parties: a western party commenced work in the vicinity of Yarmouth and is working eastwards and an eastern party commenced work at Windsor, and is working westwards to meet the other party in the most thickly infested region.

The reports up to date indicate that the situation is more serious this year. Scattered winter webs have been found between Yarmouth and Weymouth and in the vicinity of Weymouth more nests have been found than in any single vicinity pre-



FIG. 4. Female Brown-tail Moth (*E. chrysorrhoea* L.) depositing egg-mass on underside of apple leaf. (Slightly enlarged).



FIG. 5. Full grown caterpillar of Brown-tail Moth (natural size).
(Photos by H. T. Güssow.)

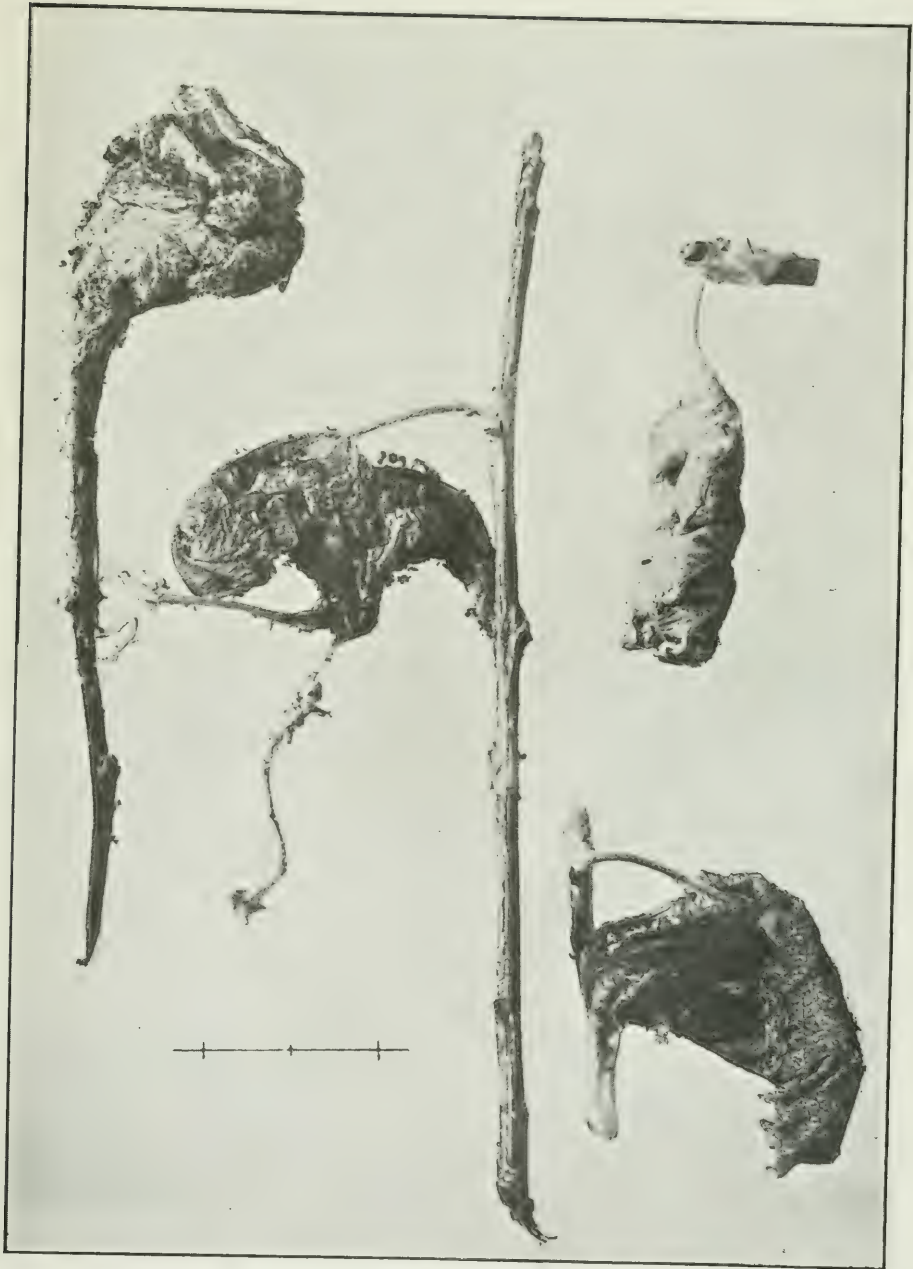


FIG. 6. Winter webs or nests of the Brown-tail Moth collected in Nova Scotia. Note the characteristic white silken attachment to the twig.

Photos by H. T. Güssow.

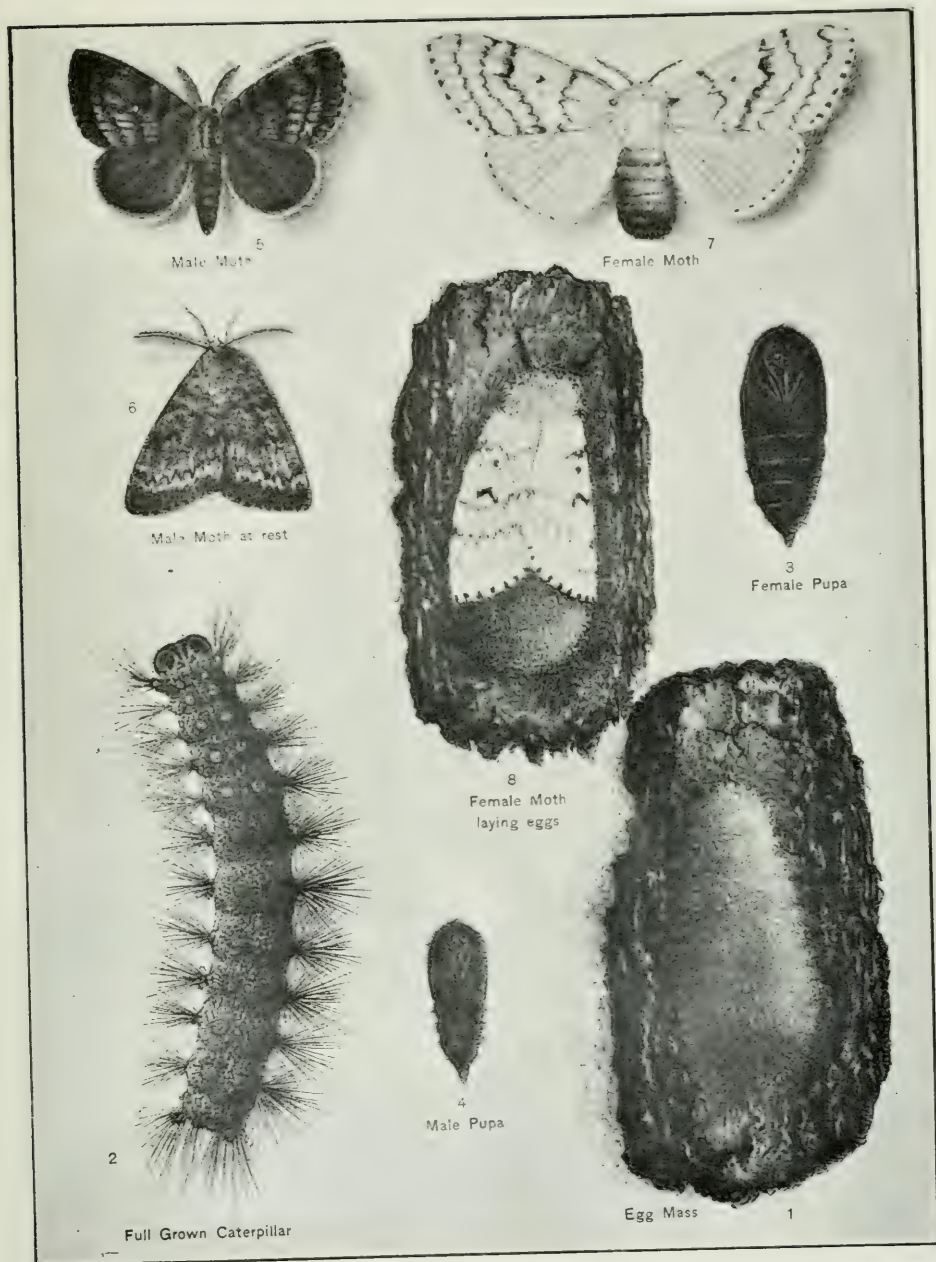


FIG. 7. The Gipsy Moth, (*Porthetria dispar* L.) the different stages of its life-history. Natural size.
(This illustration is from a coloured card circular issued by the State Forester of Massachusetts.)

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viously. This is due to the fact that the vicinity was not inspected last season and a few winter webs were found there in 1909. The importance of making this thorough and systematic inspection is indicated by the fact that some of the winter webs, which might be left were the inspection not thorough, have been found to contain an abnormally large number of caterpillars. One web was found to contain as many as 1,785 young caterpillars. Most of these winter webs are found on apple trees in small orchards and especially in trees near to the windows of houses. Observations in the field indicate the extent to which the lights from the windows serve to attract the night-flying female moths.

There is no doubt that the chief manner in which the Brown-tail Moth has been introduced into Nova Scotia has been by means of small vessels trading between Boston and other New England ports, where the insect is so abundant, and the small ports of Weymouth, Bear River and Bridgetown. On investigation I found at these points all the conditions necessary for a successful landing in the port of the caterpillars and moths. Wild apple and thorn, on both of which the caterpillars feed, occur in close proximity to the wharves where the vessels are unloaded and where any goods upon which caterpillars had been carried across the Bay of Fundy, would lie. The absence of any serious outbreak at Yarmouth is explained probably by the entire absence of these trees near the wharves. But where trees are near the wharves as is the case at Weymouth, Bear River and Bridgetown, there we have discovered heavy infestations of the caterpillars. In other cases the moths may be transported across from the New England States, either on vessels or by the wind. That the latter method of dispersal is not improbable is shown by the fact that male specimens of the Brown-tail Moth have been captured on the coast and inland near lights in Yarmouth County. In one case a nest was found on a tree in front of the window of a farm house some distance from the coast. During the flying period the light from the windows illuminated this tree and no doubt a female moth was attracted on this account and deposited her eggs. Other instances were found of the influence of lights attracting the female moths in flight to trees situated near to windows habitually illuminated during the flying period. This flying period commences about the second week of July.

INSPECTION IN NEW BRUNSWICK.

Owing to the fact that the Brown-tail Moth had extended along the coast of the State of Maine as far as the international boundary, the St. Croix River, and had been recorded at Princeton, Maine, it was considered necessary to have the southeastern region of the province of New Brunswick carefully examined for signs of the insect's invasion. Mr. W. McIntosh in previous years has taken moths at lights in St. John, N.B., but no traces of the insect having established itself in the province had been discovered by the investigations which Mr. McIntosh had made on behalf of the provincial government. Accordingly, two of our field officers, Messrs. G. E. Sanders, and R. C. Treherne, were sent to that region at the beginning of June and a careful survey was made, lasting to the end of October, of the south-eastern region of the province which was most likely to be infested. They also visited Grand Manan and other islands and during the flying season light traps were employed but with little success. Mr. Wm. McIntosh reported the taking of moths at light from July 6 to 16th and males were received from the light house on Grand Manan on August 2. The first evidence of the moth breeding in New Brunswick was a single egg mass sent to the Division on August 15, 1910, by Mr. W. S. Poole, St. Stephen, N.B., who found it on an apple tree about two miles inland from the frontier. From this egg mass we reared eight specimens of the small hymenopterous egg parasite *Pentarthrum minutum* Riley (*Syn. Trichogramma pretiosa*) which emerged on August 24 and were kindly identified for us by Mr. A. A. Girault. The hostile reception which the Brown-tail Moth thereby appeared to be receiving was of interest. Beyond this discovery no fur-

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ther evidence of the insect having established itself in the province could be discovered at that time. On March 21, 1910, however, Mr. W. W. Hubbard, Secretary for Agriculture for New Brunswick, reported the discovery of a single nest of the Brown-tail Moth found by Mr. Fred McInnis at Pomeroy Ridge, Charlotte County.

A few days later an inspection by Mr. Wm. McIntosh of the Provincial Department of Agriculture, resulted in the discovery of 34 nests, indicating that the insect



FIG. 1. Distribution of the Brown-tail and Gipsy Moths in the United States and Canada in 1910.

has now established itself in the province. Our officer, Mr. G. E. Sanders, was immediately sent to the district to make a thorough inspection assisted by an officer of the Provincial Department of Agriculture.

The history of the Brown-tail Moth in Canada is briefly as follows:—

1902. Mr. Wm. McIntosh of St. John, New Brunswick, took a single male specimen about 20 miles from St. John, N.B. Mr. G. Leavitt also took one.

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1905. In July, Mr. John Russell took a specimen of the Moth at Digby, Nova Scotia.
1907. A single winter web was received by the Division from Mr. C. P. Foote, Lakeville, Kings County, Nova Scotia. Immediate investigation revealed the presence of several thousand webs in Annapolis and Kings Counties.
1909. Winter webs containing living caterpillars were found in shipments of seedling nursery stock imported into Ontario, Quebec and British Columbia, from France, as a result of the inspection of these shipments.
1910. A single egg mass received in August, from St. Stephen, New Brunswick.
1911. Winter webs discovered at Pomeroy Ridge, Charlotte County, N.B., being conclusive evidence of the establishment of the insect in New Brunswick. The infestation in Nova Scotia also discovered to be greater.

The life history and habits of the Brown-tail Moth have been described in previous reports of the Division (1906 and 1909). By the distribution of these reports, by public lectures and communications to the press, the public are becoming acquainted with the facts and the nature of the serious results which would follow the firm establishment of the pest in Canada. The financial loss alone would be enormous. We have the experience of the New England States in fighting the Gipsy and Brown-tail Moths to indicate the importance and necessity of taking every possible means, no matter what it may cost, to maintain control of, if not to eradicate, this pest while we are able, as I am convinced we are at present. Some idea of the amount which has been expended in the State of Massachusetts alone on the work of preventing the spread of the Gipsy and Brown-tail Moths may be gathered from the following figures. The work was commenced in 1890, and continued until 1900, during which period the total expenditure amounted to \$1,175,000. In 1900, the work was discontinued at a time when control was being obtained and the spread was being prevented. Owing to this most serious mistake, both of the moths spread rapidly and in 1905, the State was compelled to undertake the work of preventing the spread, but now on a far larger scale as may be judged from the expenditure. The State of Massachusetts has expended from May, 1905, to January, 1910, the sum of \$5,500,000, and the Federal Government has expended \$417,763.84, making the enormous total of \$5,917,763.84. This does not include the amounts spent by corporations and individuals in fighting the insect. I am informed by Mr. F. W. Rane, State Forester of Massachusetts that over \$1,000,000 is being expended annually in that state in the fight against the Gipsy and Brown-tail Moths.

EFFECT OF TEMPERATURE ON THE BROWN-TAIL MOTH.

Two factors will govern the distribution of the Brown-tail Moth in Canada: the coniferous forests and the minimum temperature. Unlike the Gipsy Moth, the Brown-tail Moth does not feed upon coniferous trees and therefore the presence of these trees in a pure condition will limit the distribution of this species of moth.

The limiting power of a minimum temperature, however, is an extremely important one to take into account in considering the possible distribution of the Brown-tail Moth in Canada, where in certain regions an extremely low temperature may be maintained for some length of time. For this reason, therefore, the experiments of Grevillius* are of very great interest and importance. He carried out with the aid of various freezing mixtures by means of which very low temperatures could be produced, a large series of experiments on the effect of low temperatures on the hibernat-

* Grevillius, A. Y. 'Zur Kenntnis der Biologie des Goldafters (*Euproctis chrysorrhæa* L. Hb.) und der durch denselben verursachten Beschädigungen' *Botanische Centralbl.* Vol. 38, Abt. II., pp. 222-322, 8 figs. 1905.

ing larvæ in the nests. It was found that the larvæ in rather small nests were killed by exposure for a short time to a temperature of -30 degrees C. (equals -22 degrees F.) In larger nests containing about 120 to 350 larvæ, all the larvæ were killed with a minimum temperature of -35 degrees C. (equals -31 degrees F.). Many of the winter webs found in Nova Scotia are considerably larger than those used by Grevillius in his experiments and a much lower temperature would, therefore, be needed to kill all the larvæ contained in such large nests. Sanderson* has studied the effects of a low temperature on the mortality of the larvæ of the Brown-tail Moth in Maine and New Hampshire. He found that in the case of average-sized nests containing 300 or 400 larvæ, 72 per cent to 100 per cent of the larvæ were killed by a minimum temperature of -24 degrees F. or lower, a less percentage being killed in the case of larger nests. Grevillius records the interesting fact that at Kasan, which is the northern limit of the Brown-tail Moth in Russia, the mean annual minimum temperature is about -26 degrees F. which is practically the same temperature as that which his experiments indicated as being the lowest at which the larvæ could exist.

Although these experiments and observations would appear to indicate the possibility of predicting the approximate distribution of the Brown-tail Moth in eastern Canada, there are other factors governing the distribution which prevent the attainment of positive conclusions from a study of the minimum isotherms alone.

THE GIPSY MOTH (*Porthetria dispar* L.)

This insect has not yet reached Canada, but as it is spreading northward through the State of Maine and is slowly approaching the frontier, it is of the greatest importance that its appearance in the various stages should be known in Canada. It is liable to be carried in many ways. The caterpillars may be transported on freight and other goods shipped into Canada by railroad or boat from the infested region which is shown in the accompanying map. They are also carried on vehicles. The egg masses also may be transported on goods, especially on lumber. The various stages in the life-history of the insect are illustrated herewith. (This illustration is from one published and distributed by the State Forester of Massachusetts).

The eggs are deposited in yellowish or light-brown felt-like masses which are about three-quarters of an inch long. They are usually deposited on the trunks of the trees and in crevices, but they may also be found in all kinds of situations: on buildings, on fences and lumber, in boxes and among rubbish. The eggs hatch about the beginning of May and the caterpillars immediately begin to feed. They feed on the foliage of practically all trees, orchard, shade and forest trees and shrubs. As defoliating insects they are more serious than the Brown-tail Moth owing to the fact that they strip coniferous trees which are killed by repeated defoliation. They will also attack garden and field crops and even grass. As the caterpillars become larger they feed at night, hiding in clusters during the day in crevices, etc. By the beginning of July the caterpillars are usually full-grown. The full-grown caterpillar is from two to three inches in length, dark-brown or greyish in colour with two rows (four pairs) of blue spots succeeded by two rows (six pairs) of red spots along the back. The body is provided with tufts of long hairs. They pupate in those situations in which the egg masses are found and also in the foliage.

The moths emerge about the end of July or beginning of August, according to the locality and season. The male moth is yellowish brown or light brown in colour, having the fore wings banded with wavy darker brown bands, as shown in the illustration. It measures about one and a half inches across the wings. The antennæ are feather-like. The female moth is almost white in colour. The fore wings are banded with four wavy dark lines and there is a series of black dots around the outer margin of both pairs of wings. The wing expanse is about two and a quarter inches. As the

*Sanderson, E. D. 'The influence of minimum temperatures in limiting the Northern Distribution of Insects.' *Jour. Econ. Entom.* Vol. I., pp. 245-262, 7 maps, 1908.

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female is very heavily bodied, she does not fly but deposits the eggs to the number of about five hundred in the characteristic felt-like masses.

The young caterpillars are destroyed by spraying the trees with an arsenical poison; lead arsenate is the usual poison employed. When the larvæ are older they are more difficult to kill; advantage is taken of the fact that they descend the trees in the early morning to shelter during the day. On ascending the trees they are caught either by means of a strip of folded burlap or a band of 'tanglefoot' or other sticky substance around the tree. Probably the most effective method of destroying this pest is the destruction of the egg masses, which can be accomplished any time from the end of August to the middle of April. They are easily seen and usually accessible and are destroyed by the application of a dab of creosote. This can be done by means of a small stiff-bristled brush.

Most careful watch should be kept for this species and any suspected insects should be immediately mailed to the Division of Entomology for identification. Those regions which are specially liable to become infested with the Gipsy Moth are the regions already infested with the Brown-tail Moth, namely, those parts of New Brunswick, adjoining the State of Maine and the maritime regions of Nova Scotia, especially where there is any communication with the ports of Massachusetts and southern Maine.

FUMIGATION WITH HYDROCYANIC ACID GAS.

During the year a number of cases have occurred where buildings such as houses, warehouses and mills required fumigation for insects. When general infestations of certain insects occur in buildings, fumigation with hydrocyanic acid gas is the most effective mode of eradication. In many of our Canadian flour mills very serious losses are incurred by the presence of the Mediterranean Flour Moth, *Ephestia kuehniella* Zell, which may also occur in warehouses. We have also received specimens of the larvæ of the Spider Beetle (*Ptinus fur* L.) from flour mills in Manitoba and Saskatchewan. These and other mill infesting insects, but not all species, can be destroyed successfully by fumigation. Occasionally houses may become seriously infested with a species of insect which it may be desirable to eradicate: such eradication can be effected only by fumigation.

Fumigation is effected by hydrocyanic acid gas which is generated in the building. *This gas is one of the most deadly poisons existing and consequently the greatest care must be taken in carrying out these fumigation operations, otherwise the results may be fatal.*

Before fumigating a building, all the openings to the exterior, except the door, must be sealed up. Cracks and crevices may be filled with wet paper or covered with strips of paper and the room or rooms made gas-tight. Provision must be made for the ventilation of the room or rooms from the outside after fumigation. All moist foods and liquids should be removed before fumigation or they may take up the poison. Where mills are to be fumigated they should be thoroughly cleaned previous to fumigation. The cubical contents of the space to be fumigated must be calculated by multiplying the height of the chamber or room by the length and this by the breadth; this will give the number of cubic feet.

The gas is generated by adding dilute sulphuric acid to potassium cyanide. In practice this is reversed. The proportion of the chemicals are as follows for every 100 cubic feet of space:—

Potassium cyanide	1 oz. by weight.
Commercial sulphuric acid	1 " "
Water	2 fluid ozs. by measure.

The potassium cyanide must be 98 per cent pure. The sulphuric acid should be concentrated, having a specific gravity of 66 degrees Beaume. If the building is poorly

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constructed it will be necessary to double the quantities for each 100 cubic feet. The most convenient method of generating gas is as follows: Supposing the chamber to be fumigated is 20 feet long, by 20 feet broad and 10 feet high, the cubic capacity would be 4,000 cubic feet. As each 100 cubic feet requires one ounce of potassium cyanide and the remaining chemicals in equivalent proportion, we should require 40 ounces of potassium cyanide, 40 ounces of commercial sulphuric acid and 80 fluid ounces of water (4 pints). Two deep, fairly wide-mouthed earthenware vessels will be required. Into each pour forty ounces of water and slowly add 20 ounces of the commercial sulphuric acid. The potassium cyanide should be divided into two equal parts of 20 ounces each; each part to be wrapped in thin paper. All is now ready for the generation of the gas, if the chamber has been securely sealed. Stand each of the generating jars containing the dilute sulphuric acid on the floor on several sheets of paper to prevent any injury should the acid splash over. As quickly as possible drop the cyanide tied up in this paper into the jars; the one farthest from the door should be dropped in first and the next immediately after so that the door may be reached before much of the gas has been generated. The door should then be tightly closed and sealed for three or four hours, or, if possible, overnight. The greatest care must be taken that no person enters the room until it has been thoroughly ventilated after the fumigation is complete. After fumigation the ventilators should be opened from the outside, as provided and the room must be thoroughly ventilated for at least one hour before it is entered. A single person should not carry on these fumigation operations or an accident might prove fatal.

It is not advisable to fumigate one room of a house only. The gas is lighter than air and very permeable, in consequence of which it would penetrate other rooms and have serious effects. It is always advisable to fumigate the whole house in case of

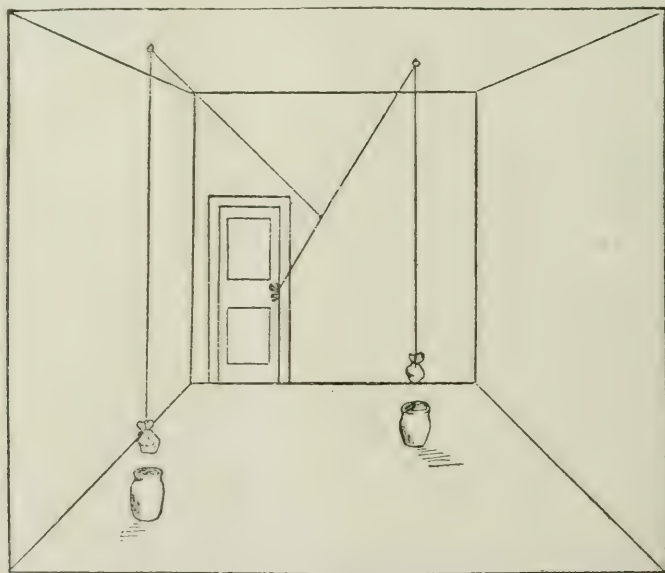


FIG. 2. Diagram illustrating method of stringing a room for fumigation with hydrocyanic acid gas.

serious infestations, beginning with the upper rooms, as the gas is light. Notices should be given to those in adjoining houses and others who might be affected by the gas, and a person should remain outside while the operation is being carried on. Too many precautions cannot be taken in using a gas of the fatal and powerful nature of hydrocyanic acid gas.

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In most cases it would be more convenient and considerably safer to arrange for the dropping of the cyanide into the sulphuric acid to be controlled from the outside. This can be done as shown in the illustration. The cyanide wrapped up in thin paper is suspended over the dilute sulphuric acid in the generating jar by means of a string. This string passes through a ring in the ceiling immediately over the jar and is controlled through a small hole in the door. In this manner the cyanide may be lowered into the generating jar after having sealed up the door. By the use of additional rings and strings any number of jars may be used according to the size of the chamber to be fumigated. In the case of large rooms, greenhouses and mills, where several jars are required, this practice should always be followed. It is not advisable to use more than $1\frac{1}{2}$ to 2 lbs. of cyanide to each jar. After the room or building has been ventilated care should be taken in the disposal of the chemicals remaining in the generators which should be most carefully cleaned out and the contents buried or thrown into a sewer. Fumigation with hydrocyanic acid gas will kill the adults and larvæ of many of the insect pests, but it will not destroy the eggs nor all the chrysalids of the moths. In order, therefore, to prevent a reinfestation by the hatching out of eggs or the emergence of moths from the chrysalids which have survived the fumigating process, it will be necessary to fumigate a second time about three weeks later.

Some interesting experiments have been recently carried on by Prof. R. Harcourt* of the Ontario Agricultural College, Guelph, on the effect of mill fumigants on flour and the results are of practical importance. Carbon bisulphide, which is sometimes used as a fumigating agent, has a very marked injurious effect on both wheat and flour. It was found that bread made from flour which had been fumigated with carbon-bisulphide in the usual proportions did not rise well and had a poor colour and texture. On the other hand, fumigation with hydrocyanic acid gas did not affect in the least the baking qualities of the flour, in fact, Prof. Harcourt stated, it would almost seem to have improved the flour.

INSECTS AFFECTING LIVE STOCK.

In the western provinces, horses and cattle are affected to no small degree by various species of biting flies, popularly known as 'Horse Flies' or 'Gad Flies,' most of which belong to the classes of two-winged flies known as the *Tabanidae*, and the *Chrysopidae* which include the smaller biting flies with banded wings. These insects inflict very painful bites upon horses, cattle and other animals, including man. The larvæ are carnivorous and live in water or moist earth. Correspondents have asked if there are no means of protecting horses, etc., from the bites of these and other flies such as the Black Flies (*Simulium* spp.). Many solutions having a repellant odour have been used for this purpose with varying success. The chief difficulty is that the repellent is not effective for long and when such repellents are used they must be applied about twice a day. A solution of oil of tar has been found to be as effective as most of the repellents and it is made as follows:—

A quantity of coal tar is placed in the bottom of a large shallow receptacle and a small quantity of oil of tar or oil of turpentine is stirred in. The vessel is then filled with water which is left standing for several days until it is well impregnated with the odour. The animals are then washed with this as often as may be deemed necessary.

THE WARBLE FLY (*Hypoderma lineata* Villiers).

Throughout Canada 'warbles' occur on cattle. From reports received they appear to be very abundant in the western provinces of Manitoba, Saskatchewan and Alberta, and the losses which result from their occurrence are an

* *Thirty-sixth Annual Report of the Ontario Agricultural College and Experimental Farm, 1910* (Toronto) pp. 87-92, 1911.

enormous tax on farmers, stock raisers and tanners. Their presence entails the following: loss of flesh in beef and milk cattle, reduction in the milk producing power and other strains on dairy cows and very great loss in the manufacture of the hides owing to the presence in them of the holes made by the maggots. I am informed that it is customary to deduct two dollars from the value of every steer on account of warbles. Thirty years ago it was estimated that the annual loss in the United States caused by the warble fly was about ninety million dollars. Yearlings and heifers suffer most from the attacks of this insect. It is undoubtedly one of the most serious insect pests attacking cattle and at the same time one that is difficult to control. The 'warbles' are tumours caused by the larvae or 'maggots' of the warble fly. The larva sets up irritation beneath the skin with the consequent production of pus and blood upon which it feeds. The warble flies are abundant during the summer and fly in the fields from June to the end of August. They are about half an inch long and covered with hairs like a bumble bee, the hairs being black, white and yellow or reddish brown. They fly in the bright sunshine but do not bite or sting which makes all the more remarkable the fact that their presence will cause cattle to stampede and rush wildly about. The eggs are laid on the hairs of the animals by the fly during the summer and are firmly attached to the hairs. It is believed that most of the eggs are laid on the legs and heels of the cattle and rarely on the backs and sides. How the maggot reaches its final position beneath the skin has not been determined with certainty. It may either bore straight into the skin or it may be licked into the mouth and from there work its way through the tissues to reach its final position beneath the skin. Prof. Carpenter, of Dublin, Ireland, who for six years has been conducting experiments on this insect and its method of control * has found young maggots imbedded in the tissues of the gullet of young cattle slaughtered in August and October. Stroset has found that in the case of *Hypoderma bovis*, which probably does not occur in North America, some of the larvæ probably enter the body through the skin. He also found that the full-grown larvæ leave the host chiefly during the night and early morning. By whatever way the maggots gain entrance they finally arrive beneath the skin on the backs of the animals about February and then give rise to the 'warbles.' When the maggots are wandering through the tissues before reaching the back they are smooth but having arrived beneath the hide they moult and become spiny. A hole is now made in the warble through which the maggot breathes by means of two openings or spiracles at its tail end. The maggot becomes full grown about the end of April or beginning of May (in Eastern Canada) being now about an inch long. The 'ripe' maggot works its way out of the warble and falls to the ground where its skin hardens to form a brownish black case or puparium from which the fly escapes in about four to six weeks.

Remedial Measures.—It was formerly thought, and the belief is still widely prevalent, that the flies could be deterred from depositing their eggs on the backs of cattle if various dips and smears were applied during the summer months. Prof. Carpenter's investigations have shown that no reliance can be placed on such supposed preventives. Nevertheless there is much evidence to show that the systematic destruction of the maggots in the spring before they leave the warbles is productive of very beneficial results. It will be readily understood, that if the maggots are thus destroyed in all the herds throughout a whole district, the number of warble flies will be considerably reduced. Co-operation is necessary. In Denmark ||, this method has been adopted with considerable success and co-operation in the systematic destruction of the maggots has resulted in a marked decrease in the prevalence of warbles in those districts in which the work has been carried on. There is no doubt that, if this work

* Journ. Dept. Techn. Instr., Ireland, Vol. 8, pp. 227-246, Vol. 9, pp. 465-476 & Vol. 10, pp. 612-650 (1910).

† Arb. K. Gesundheitsamt, Vol. 24, pp. 41-73 & figs. 1910.

|| Bulletin de la Société Nationale d'Agriculture, Nos. 3 & 6, 1910.

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is thoroughly done, the warbles in any given locality can be reduced to harmless proportions. Further, by the employment of a special man, the cost has been shown to be very small, in Denmark from two to five cents per head.

The best method of destroying the maggots is that of squeezing them out of the warbles which can be easily done when they are ripe. The first examination and destruction should take place in April, and two others in May and June respectively. If the skin is hard it may be softened by washing with a solution of salt and water, using half a pound of salt to three gallons of water. The maggots may also be destroyed by smearing the warbles with a mixture of equal parts of kerosene and pine tar carefully mixed. This mixture fills up the breathing pores of the maggot which dies in consequence. This method, however, is to be less recommended than that of squeezing out the maggots, and it should not be confused with the summer smearing of the backs of the cattle which was formerly recommended, but which has been shown to be useless as a preventive. Wherever it is possible cattle should be allowed to have access to shade trees and water in the summer as the warble flies dislike water and are most active in bright sunshine.

TICKS ON HORSES.

In the spring of 1910, and again in the present year (1911) specimens of ticks were received which Dr. Nathan Banks kindly identified for me as *Dermacentor albipictus* Packard. Mr. G. E. Parham of Penticton, B.C., found them on horses. Through the co-operation of the Veterinary Director General of this Department, further specimens were received from Mr. Ransom, of Vancouver, B.C., who took them from a horse in quarantine at Huntingdon, B.C. This horse had been imported from Elgin, Oregon, and had been running wild all winter. Dr. A. E. Moore, of the Veterinary Branch, also brought specimens obtained from elks imported into Quebec from Wyoming, U.S.A. A study of the life history of this species was begun in 1910, but the records unfortunately were lost. Egg laying commenced at the end of April, and single females deposited from 3,000 to 5,000 eggs during the succeeding months of May and June. These eggs were deposited in the characteristic manner and began to hatch early in July. The young six-legged 'seed ticks' soon climbed up the leaves of grass and collected in large numbers on the tips of the leaves awaiting an opportunity to reach the hairs of the host. When they reach the host such as a horse or elk they crawl over the hair and attach themselves to such a place as the inside of the thighs. Here they moult and now have eight legs. The males are more active than the females which, after mating, increase in size and drop to the ground to deposit their eggs. This species occurs throughout the northern parts of the United States where it has been found on cattle, horses and certain wild animals such as the elk, upon which it is common, and the moose. It has also been found on the beaver.

Two methods of eradication are possible, namely, the destruction of the ticks on the host and in the pasture. They may be destroyed in the pasture either by excluding the horses and cattle for a certain length of time, thus starving out the ticks, this method being called the rotation method, or by allowing the horses to have access to the infested pastures and afterwards destroying the ticks upon the hosts by treating them with certain washes or dips. For the destruction of the ticks upon the host the United States Department of Agriculture* as the result of a long series of experiments recommended an emulsion of crude petroleum made according to the following formula:—

Hard soap	1 lb.
Soft water	1 gallon.
Beaumont crude petroleum	4 gallons.

* U.S. Dept. Agric. Farmers Bulletin No. 378. 1909.

This makes 5 gallons of 80 per cent. emulsion. The soap should be cut up and dissolved in the requisite amount of water by boiling, adding water to make up for that which is lost by evaporation. The soap solution and oil are mixed thoroughly to form an emulsion. This stock solution will keep, and for use a 25 per cent solution should be made by using one part of the stock solution to $2\frac{1}{2}$ parts of water. Beaumont oil is recommended as being less injurious than the heavier varieties of oil, and not so volatile as the lighter oils. Cattle should be sprayed with a 20 to 25 per cent. emulsion every fortnight. Every part of the animal, especially the inside of the thighs and elbows and dewlap should be thoroughly sprayed. Horses should be freed by picking. Certain species of ticks carry organisms of serious diseases, as for example the tick *Margaropus annulatus* of the southern United States, which is the carrier of the organism causing the dangerous Texas Fever. Redwater Fever is also transmitted by ticks.

THRIPS ATTACKING CEREALS.

During the last few years frequent inquiries have been made in reference to the 'blighted' appearance of the heads of oats and wheat and a number of samples of the injured plants were received. Oats were chiefly attacked with the production of the characteristic 'silver top' or 'white top' appearance. Most of the reports of injury were received from Alberta and Saskatchewan. One correspondent from Vancouver Island, B.C., stated that over 50 per cent of a fourteen acre field of oats were attacked. On heads of oats received from Saskatchewan from fifty to seventy per cent of the ears were destroyed and had the typical bleached appearance. Mr. A. Mackay, the Superintendent of the Experimental Farm at Indian Head, Sask., informs me that he has noticed the 'silver-top' on oats for several years, but especially during the last year or two.

We were unable to obtain specimens of the insects from most of the samples as they were dry on arrival here, owing to the long journey and the few insects obtained were too dessicated to make their identification possible. This species may be the Grass Thrips (*Anaphothrips striatus* Osborn), and Mr. F. M. Webster, of the United States Bureau of Entomology showed me a record which he had of this species attacking oats. The Grass Thrips produces 'white' or 'silver top' in a number of grasses, especially in Kentucky Blue Grass (*Poa pratensis*). Dr. Fletcher recorded the occurrence of 'white top' in 1888 and 1892 in *P. pratensis* and also in Timothy (*Phleum pratense*) and Couch Grass (*Triticum repens*). 'White top' in wheat is usually caused by the work of the Wheat-stem Maggot (*Meromyza americana* Fitch), but the specimens of white top in wheat which we received were undoubtedly caused by thrips.

Other species attacking oats are *Eolothrips fasciatus* L. (which also attacks wheat, grasses and weeds) and *Limothrips cerealium* Hal. It is not unlikely that these species occur in Canada.

These insects are minute and in consequence generally escape observation. The Grass Thrips (*A. striatus*) measures about one-sixteenth of an inch in length and is yellow or brownish yellow in colour. The adults are provided with four narrow wings fringed with long hairs and are very active. There is, however, considerable variation in the possession of wings and in the condition of the same in this peculiar family of insects. Their mouth parts are adapted for both sucking and biting, but they appear to take most of their food by sucking the juices of the plants. According to Hinds* the life history is briefly as follows: The females continue to deposit their eggs on the leaves of the grass and the young develop through the fall until the snow covers the ground. The adults hibernate and appear to be able to withstand exposure to tempera-

* Hinds, W. E., 'Contribution to a Monograph of the insects of the order Thysanoptera inhabiting North America.' *Proc. U.S. Nat. Mus.* Vol. 26, pp. 79-242, 11 pls, 1902.

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ture of -21 degrees F. The females become active in the spring, probably as soon as the snow disappears and the eggs then begin to develop. The length of the egg state in the spring is from ten to fifteen days and in the summer from four to seven days. The larvæ are similar in general form to the adults. The length of the larval stage varies from two weeks in the early spring to about four days in midsummer. The first winged adults appear in May or June. The whole life cycle occupies from twelve to thirty days.

Korolikoff* has recently investigated several species of thrips injurious to cereals and grasses in Russia in the neighbourhood of Moscow. He found that the insects passed the winter in the green, soft tissues in the leaf sheaths of young plants, and when the spring comes they migrate to the early cereals and later to the summer crops. Their injuries to plants are caused chiefly by the fact that they feed upon the juices of the different parts of the flowers, and especially on the ovary, that is, in the cereals, the young grain. They migrate from one species of plant to another, for example, from rye to wheat and oats. He recommends the destruction of weeds, especially those belonging to the families Leguminosæ, Gramineæ and Compositæ, and the sowing of what one may term 'bait' crops such as rye or oats round the fields under cultivation. This should be done a fortnight before the time of sowing the winter cereals in order to attract the insects and afford them shelter when the crops are coming up. When the 'bait' crops are removed later, a large number of the thrips are removed also.

The various species of thrips appear to hibernate where they have been feeding: in the stems of grains which have died down, in crevices in the ground or under rubbish. In the case of species infesting cereals and grass crops they can be attacked only by the adoption of cultural methods. The hibernating stage is the most convenient stage of their life history to combat them. The burning of the grass or stubble in the fall and, either as an additional measure or as an alternative, the deep ploughing of the soil, will result in the destruction of a large portion of the hibernating individuals. Grain which has been infested should be cut as early as possible in the spring to remove the individuals recently emerged from hibernation before they have reproduced in any considerable numbers. After threshing, the screenings and chaff which contain large numbers of the insects, should be burnt.

THE WHITE-MARKED TUSSOCK MOTH (*Hemerocampa leucostigma* S. and A.)

This insect was extremely abundant in certain places in Ontario, New Brunswick, Nova Scotia and Prince Edward Island during the summer of 1910. In the cities of Halifax, N.S., and Charlottetown, P.E.I., and Kingston, Ont., its defoliation of the shade trees, well known in Toronto, caused the citizens some alarm. In Charlottetown, I found on examination that the larvæ had been fairly well parasited, and to some extent also in Halifax. Further observations on collected material indicate the same fact. It is not improbable that the outbreaks will be checked by natural means, but the uncertainty of the operation of such natural controlling agencies as the experience of the insect in Toronto exemplifies, necessitates the employment of thorough eradication measures in cities where the value and importance of shade trees is unusually great.

Life history.—During the winter the conspicuous white or creamy-white egg masses having a frothy appearance may be found on the trunks and branches of trees, on fences and other places to which the caterpillars crawled when full grown. The young caterpillars hatch out at the end of May or early in June, and become full grown towards the middle or end of July. The mature caterpillar is distinct in form

* Korolikoff, D. M., 'Tripsi jivoustchie na naciikh Slakakh.' *Izvestiia Moskovskago Selskhoziaistvennago Instituta.* (Annals of Agron. Inst. Moscow), Vol. 16, pp. 192-204. Moscow, 1910.

and colouration. It is hairy and measures from one and a quarter to one and a half inches in length. The upper side is dark with two longitudinal yellow stripes along the back. The head is coral red and there are a pair of tufts of black hairs projecting over the head in horn-like manner; a similar but single tuft of hairs projects from the hind end of the body. On the back of the caterpillar, beginning in the fifth segment, there are four white brush-like tufts of hairs and behind these there are two small, glandular projections of a brilliant red colour. The caterpillars usually leave the smaller branches when they have finished feeding and are full grown and wander down the trees to the larger limbs and trunks where they spin their cocoons in the crevices of the bark. Large numbers of the full-grown caterpillars wander some distance, finally spinning their cocoons on fences, the sides of houses and other places. In about a fortnight the moths emerge. The peculiarity of this insect is that the female moth is wingless and consequently is unable to fly. After emerging, the female rarely leaves the neighbourhood of the cocoon, but after mating deposits one to five hundred eggs in a white frothy mass on the outside of the cocoon. The male moth is grayish and measures about one and a quarter inches across the wings; the antennæ are large and feather-like, and a white spot in the outer hind angle of each of the fore wings gives the insect its popular name.

Natural enemies.—A number of species of birds feed on the hairy caterpillars of this insect, including the robin. Surprise has frequently been expressed to me that the English sparrow does not appear to feed on the caterpillar. The English sparrow not only does not feed on this insect, but it drives away those birds which do so, and is itself one of the greatest pests on this account, as it has driven away and thereby reduced in number many of our useful insectivorous birds. The most important natural enemies are parasitic insects.

Means of control.—The most effectual method of controlling this insect is by the destruction of the egg masses during the winter months. As the insect is in this stage for about six months or longer, ample time is afforded for the carrying out of a systematic campaign of egg destruction. The egg masses may be either collected and burned or destroyed on the trees by applying creosote by means of a small brush which may be attached to a long pole. On fences and other places they may be killed by means of a gasoline torch lamp such as painters use. When all the egg masses on a tree have been destroyed, a band of 'tanglefoot' about three inches wide should be painted round the trunk. This should be done before May and it will prevent any caterpillars which have hatched from eggs which have not been destroyed, from ascending the trunks of the trees; as all the egg masses on the tree will have been destroyed, no caterpillars will be able to gain access to the leaves on account of the band of 'tanglefoot.' A sticky substance similar in nature to 'tanglefoot' may be made by boiling together equal parts of castor oil and resin. The bands on the trees should be scraped from time to time with a wooden comb to keep the sticky surface fresh.

When the egg masses have not been destroyed, the trees should be sprayed before the end of June with an arsenical spray such as lead arsenate. This is used in the proportion of 3 or 4 lbs. of lead arsenate to 40 gallons of water. All cities having valuable shade trees attacked by this or other defoliating insects, should have a power sprayer. Nothing is more injurious to the tree or unsightly to the eye than the defoliation by caterpillars. Many of the cities of the United States regularly spray their shade trees, realizing their value as civic assets; in certain cases the losses which they have suffered in the past compel them to do this.

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THE NARCISSUS FLY (*Merodon equestris* F.).

During the past few years this insect has been noticeably present in British Columbia. It was recorded in 1908 by Prof. R. C. Osborn*, having been caught by Mr. Harvey frequenting especially the flowers of the Salmon Berry (*Rubus spectabilis*). Professor Osborn believes that it properly belongs to our North American fauna, but I am unable to agree with him on account of its history in Canada and other countries. I am of the opinion that it has been introduced into Canada on imported bulbs, as I have found the larvæ during the present year on bulbs imported into Ontario from Holland. It had been previously captured on Mount Royal, Montreal, by Mr. G. Chagnon in 1903. In British Columbia, it is now a serious pest of bulbs, and Mr. A. E. Wallace reported it as attacking narcissus and daffodil bulbs near Victoria, B.C., about 50,000 bulbs having been destroyed in the year. Mr. G. Norman† has kindly furnished me with particulars as to many of its habits in that locality which was visited in October. The perfect insect in seen from March to September and appears to begin to breed in May. The eggs are probably deposited in the centre of the leaf crown. The larvæ are found in the centre of the bulb, having made their entrance through the base of the bulb. The bulbs are destroyed by the larvæ or maggots eating away the flattened stem at the base of the bulb and afterwards destroying the centre of the bulb. Professor Ritzema Bos, State Entomologist of Holland, who has written the most complete account‡ of this insect, records the eggs as being laid in the soil adjoining the foliage. He informs me that it attacks chiefly *Narcissus tagetta* and *Jonquillas* in Holland. Mr. Norman has observed that the early varieties of daffodils, such as 'Golden Spur' and 'Henry Irving' are not attacked and that such varieties of narcissus as *N. poeticus ornatus* and *N. p. poetarum* suffer considerably.

The method of eradication which has been found most simple and efficient in Europe is the annual lifting of the bulbs and the destruction of all those which are found to be attacked by the maggots, as can readily be seen. This method has been found effective in England, and also, Professor Ritzema informs me, in Holland. Soaking in water is of no value and the destruction of the pupæ in the soil by the removal of the latter in the spring is impracticable in a large scale. Satisfactory results may possibly be obtained by poisoning the adult flies with sweetened arsenical baits, and experiments on this are being carried on in British Columbia.

NOTES ON THE MORE IMPORTANT INSECTS REPORTED TO THE DIVISION DURING THE YEAR.

The following notes refer to a number of the most prevalent insects which have been reported to and received by the Division during the past year (April, 1910. to March, 1911). Lack of space prevents a detailed treatment of these insects, but their occurrence is recorded for the sake of future reference, and for those who may desire such information as to the distribution and occurrence of certain of the more prevalent insect pests.

INSECTS AFFECTING FIELD AND ROOT CROPS.

Wireworms and White Grubs were reported most frequently. They were destructive to grass lands, cereals, roots and other field crops. Root maggots were destructive to cabbages, cauliflowers, turnips, radishes and onions throughout Canada. The experiments which we are conducting on means of controlling these insects confirm our opinion as to the efficacy of the method of protecting the cauliflowers and cabbages by means of the tarred felt paper cards. This method is fully described in the report

* *Canadian Entomologist*, Vol 40, p. 10.

† 'La mouche du Narcisse (*Merodon equestris* F.)' *Arch. Musée Teyler*, Vol. 2, pp. 45-95.

for last year. For the protection of radishes and onions, the application of the hellebore decoction, using two ounces of hellebore to one gallon of water and watering the plants about once a week, has given the most success.

The Potato Beetle (*Leptinotarsa decemlineata* Say) was unusually abundant in Ontario, and was responsible for considerable loss to growers. Mr. Norman Criddle also reported them from Manitoba where the worst outbreak on record was experienced. This insect is gradually spreading through the west, and I found that it had already arrived in the region of Edmonton, Alta.

The Blister Beetles, namely, the Western Blister Beetle (*Cantharis nuttalli* Say), the Grey Blister Beetle (*Epicauta cinerea* Forst.), and the Black Blister Beetle (*E. pennsylvanica* De G.), were abundant and destructive, especially to beans. The first was especially abundant in Manitoba and their prevalence in such numbers may be correlated possibly with the abundance of grasshoppers and locusts which were similarly reported as injurious to cereals in Manitoba. Mr. Criddle described an extensive migration of the locusts in July at Aweme, Man. The chief species were the Lesser Migratory Locust, *Melanoplus atlantis* Riley, and Packard's Locust, *M. packardii* Scudd.

The weevil *Sitones hispidulus* Germ., whose larva destroys clover, was abundant at Orillia, Ont. *Nysius erica* Schill, was reported from Medicine Hat, Alta., where it was abundant and was attacking spinach, radishes, strawberries, lettuce, turnips and corn. The Flea Beetle *Hallica evicta* Lec. was very destructive to turnips and cabbages at Halfway Lake, Alta., and the Hop Flea Beetle was again serious in the hop yards of British Columbia. The Red Spider, however, was more injurious to the hops than the Flea Beetle. I was informed that it was compelling them to cease growing hops in some localities. Instead of a crop of six or seven hundred pounds to the acre, two hundred pounds to the acre were produced and these of very poor quality. The mite could be destroyed by winter treatment of the poles on which it hibernates; they could be dipped in a caustic solution or in coal oil.

The Pea Aphis (*Macrosiphum destructor* Johnson) was present in most parts of Ontario. It appeared to check the vigour of the growing vines.

INSECTS AFFECTING FRUIT AND FRUIT TREES.

The commoner pests were reported in the usual abundance, and as the life history and means of controlling certain of these, such as the Codling Moth (*Carpocapsa pomonella* L.), the Budworm (*Imetocera ocellana* Schiff), the Apple Maggot (*Rhagoletis pomonella* Walsh), the Plum Curculio (*Conotrachelus nenuphar* Herbst), Oyster Shell Scale (*Lepidosaphes ulmi* L.) and Cankerworm were considered in the report for last year, it is not necessary to repeat them at length.

The Cherry and Pear slug (*Eriocampa cerasi* Peck), was injurious to cherry, apple and pear orchards in Quebec, Ontario and British Columbia.

Tent Caterpillars (*Malacosoma* spp.) were again extremely abundant in certain provinces, namely in New Brunswick and British Columbia. One of our officers, Mr. Tom Wilson, found the larvæ in millions at and west of Mission, B.C., and at other places in the valley of the Fraser River. Driving down to Upper Sumus, he found that the whole country had been devastated by the caterpillars, no leaves being left on the trees and the fruit hanging was half grown.

The Red-humped Apple-tree Caterpillar (*Schizura concinna* S. and A.) was very common in Ontario and was also recorded from Waneta, B.C., and Holmfild, Man. In Ontario it was found to be fairly heavily parasitised by the ichneumon, *Limneria guignardi*.

The Cherry Leaf Beetle (*Galerucella cavicollis* Lec), which feeds on the wild cherry, was reported from Halifax, N.S., as attacking cultivated cherries. Mr. L. Caesar, of Guelph, found the Cherry Fruit Fly (*Rhagoletis cingulata* Loew) attacking

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some cherries near Homer, Ont. It is not improbable that this insect is also attacking cherries in Quebec from which reports of similar injury were received. This imported insect was recorded by Dr. Fletcher in 1906*. He received it from Mr. W. R. Palmer, Victoria, B.C., where it was injuring some cherries. This was its first recorded appearance in Canada, and Mr. Palmer stated that he first noticed the holes in cherries in 1904. Infested cherries should be destroyed as soon as the injury to fruit is noticed. The Raspberry Cane Borer (*Obreia bimaculata* Oliv.) was reported generally from Ontario and Quebec, in some instances being particularly abundant. The Strawberry Flea Beetle (*Haltica ignita* Ill) was destructive to strawberry plants at Nelson, B.C.; over 180 specimens were collected from a single plant by jarring. This species also feeds upon other Rosaceæ. In Prince Edward Island the Strawberry Crown Borer (*Tyloderma fragariæ* Riley) was seriously injurious to the plants, and growers report that it is becoming more abundant annually. The only remedy is to dig up and burn infested plants before the fruiting season closes, that is, before the insect leaves the plant. Old beds should be thoroughly ploughed in the fall.

INSECTS AFFECTING FOREST AND SHADE TREES.

The Spruce Budworm (*Tortrix fumiferana* Clemens). The inquiries and reports received by the Division during last summer indicated that the depredations of the insect were more extensive than in the previous year to which reference was made in my last report. So serious did the situation appear, that many of the holders of timber limits were not unnaturally alarmed and feared the destruction of the spruce.

As the Department of Lands and Forests of the Government of the Province of Quebec, has a body of forest rangers throughout the province, arrangements were made by Mr. G. C. Piché, Chief Forestry Engineer of the Province, to obtain reports from them as to the distribution of the insect, and we drew up a questionnaire. The results of this inquiry and of the information which the Division of Entomology has received indicate that the insect is abundant in certain areas from Lake Timiskaming on the west to Lake St. John on the east and is sparingly distributed throughout the whole province down to the international boundary. The most serious devastations have been recorded from the region having River Desert and the upper Gatineau on the west to the Rouge River and Lake Ouareau on the east, from the region southeast of Lake St. John and from the River St. Maurice. In British Columbia, where I visited the infested areas last year and again this year, the most severely infested region is the southeast region of Vancouver Island from Salt Spring Island and Maple Bay south to the Saanich Peninsula. The accompanying map shows the recorded distribution of the Spruce Budworm in Canada at the present time.

In British Columbia some of the second growth Douglas Fir has been killed as a result of the repeated defoliation by the caterpillars. Visits were made to the Chicoutimi and Rouge River regions in Quebec in January. In both these regions it was found that the balsams had suffered more than the spruce. The tops of the trees were denuded not only of foliage but also of buds. The injuries had caused severe bleeding. The tops of some of the trees which were felled were dead, but otherwise no injury could be found. Nor was there any evidence of an unusual secondary invasion by bark beetles. Cocoons of Braconid parasites indicated that these natural agencies were at work. From material which Mr. Arthur Gibson collected at Baskatong in 1909, a new parasite was reared. This has been described under the name of *Nasonia tortricis* by Mr. C. T. Brues, in 'The Canadian Entomologist,' vol. 42, p. 259, 1910.

* In *Can. Ent.*, Vol. 41 p. 70, this species is described under the name *Rhagoletis intrudens* n. sp., by J. M. Aldrich.

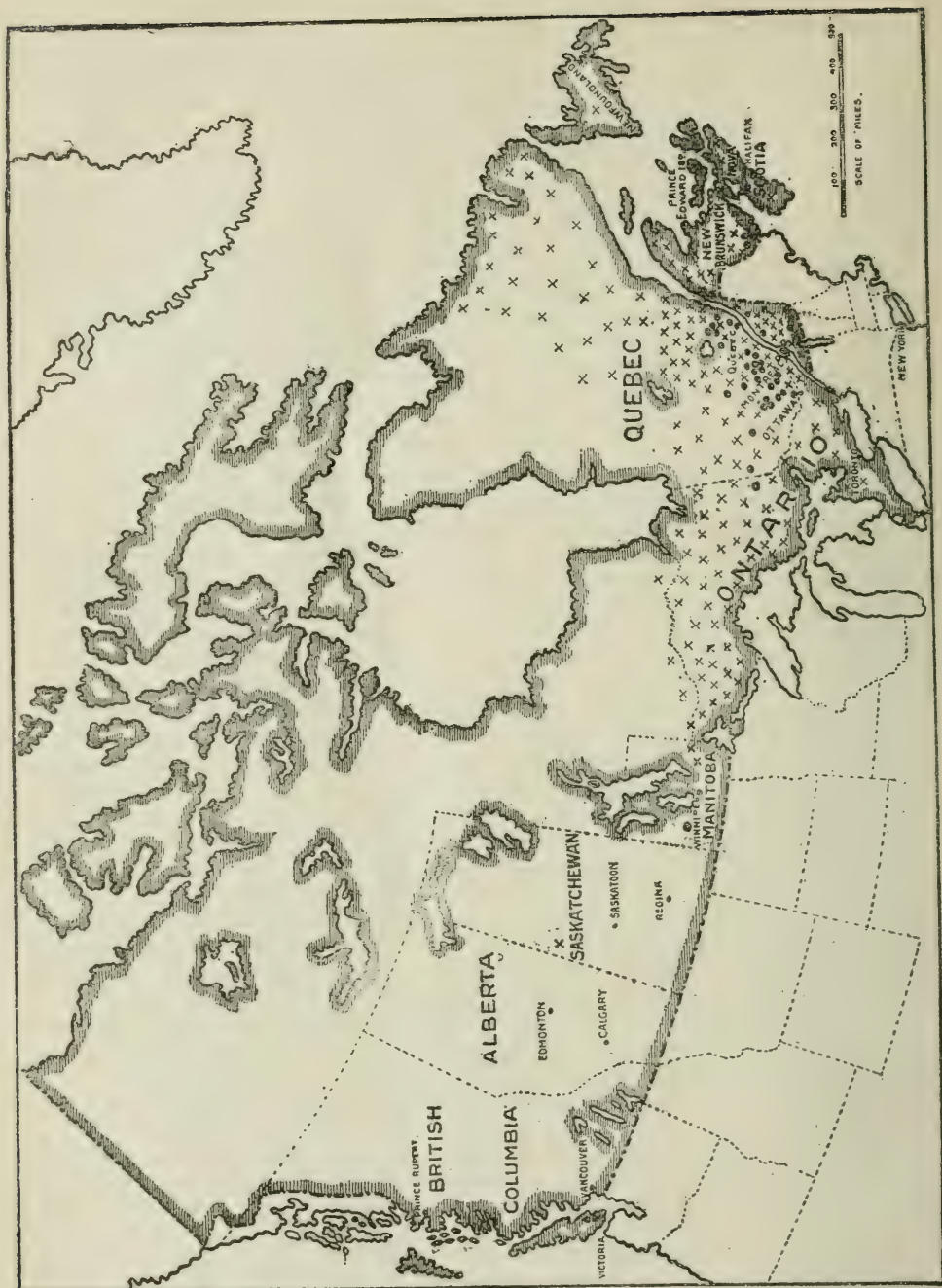


FIG. 3. The distribution of the Spruce Budworm (*Tortrix fumiferana* Clem.) and the Larch Sawfly (*Lygaconematus crichsonii* Hartig.) in Canada in 1910. Spruce Budworm indicated by black circles, the Larch Sawfly by crosses.

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Arrangements have been made for the study of the parasites of this insect and this will be carried out during the coming summer. Only by a knowledge of the character and extent of parasitism can the results of this outbreak be foretold with any degree of certainty. If the parasites are found to be increasing rapidly in number, as is frequently the case in outbreaks of insects native to the country, they will control the pest before it has accomplished the severe destruction which alarmist minds might be inclined to predict from the appearance of the forests last year.

THE LARCH SAWFLY. (*Lygæonematus erichsonii* Hartig).—The study of this insect was continued. A beginning of the study of the European parasites of this insect had been made by me before leaving England. This study was continued on account of its importance in relation to the serious nature of this insect's history in Canada. I am of the opinion that it was imported into North America and am supported in this belief by the history of the Sawfly since it was first recorded on this side of the Atlantic ocean, in 1881.

My investigations showed, and were confirmed by the continued study in England by Mr. Joseph Mangan, that the parasite, *Mesoleius aulicus* Grav., was not only the chief parasite as had been previously shown*, but had increased sufficiently rapidly to control the sawfly which was actually the case. It was found that over sixty per cent of the sawfly larvæ were parasitised. Accordingly arrangements were made for the collection of the cocoons in that region in England where the parasites had been found in so great abundance, and these parasitised cocoons are now on their way to Canada. An endeavour will be made to establish the chief parasite, *M. aulicus*, in different localities within the infested region which extends from Winnipeg, Man., to Cape Breton, N.S., as shown in the accompanying map. A beginning has also been made of the study of the native parasites attacking the sawfly larvæ. The chief of these appears to be a small Pteromalid *Coelopisthia nematocida* Packard, which deposits its eggs inside the cocoon on the hibernating larva and this is destroyed. The European and North American larvæ and adults of the sawfly were studied side by side and there is no doubt as to their being the same species.

The Birch Sawfly (*Hylotoma pectoralis* Leach) defoliated birches in the neighbourhood of Quebec and in Charlevoix county, Que., and was very destructive near Charlottetown, P.E.I. The larva is about three-quarters of an inch in length, yellowish in colour spotted with black and is usually abundant on birches in August and September. The Fir Sawfly (*Lophyrus abietis* Harr.) was abundant on spruce in Algonquin Park, Ont. Many pine trees near Magog, Que., were defoliated by Abbot's Pine Sawfly (*Lophyrus abbotii* Leach) the larva of which is yellow, spotted black and having a black head. The full grown larva measures about an inch in length.

The Spruce Gall Louse (*Chermes abietis* Chol.) was, as usual, abundant and injurious to White and Norway spruce in Ontario and Quebec. *Chermes similis* Gillette, was reported from Richmond, Que., and *C. floccus* Patch from Halifax, N.S., where it was rather seriously affecting spruce. Miss Patch finds that this species migrates to the needles of the white pine. *C. pinicorticis* was also abundant on the bark of white pine. The Green Striped Maple Worm (*Anisota rubicunda* Fabr.) defoliated maples near Newboro, Ont., and also along the shore of Georgian Bay. *A. virginensis* defoliated oaks in the former locality. The White Cedar Twig Borer (*Argyresthia thuella* Pack.) which causes the death and consequent brown appearance of the green tips of the cedar was abundant in Algonquin Park and other regions in Ontario.

INSECTS AFFECTING GARDEN AND GREENHOUSE.

A small Collembolan which Dr. Folsom kindly identified as *Xenylla humicola* (O. Fabr.) Tull., was received from Toronto and also from St. Thomas, Ont., where it occurred in enormous numbers forming patches several inches across. The Tarnished

* The Large Larch Sawfly, *Nematus erichsonii* Hartig. Journ. Board of Agr. vol. 15, pp. 649-660, 1903.

Plant Bug (*Lygus pratensis* L.) attacked and was destructive to dahlias and carnations in Victoria, B.C., also in Montague, P.E.I. Numerous inquiries were made concerning the Grape Vine Leaf Hopper (*Typhlocyba comes* Say), which attacks the grape vine and Virginian creeper, making the latter especially unsightly. It is a small insect about one-eighth of an inch long and is frequently wrongly called 'thrip' by gardeners. The injuries are caused by the insect puncturing the leaves and sucking the sap. The best eradivative measures are clearing away and burning fallen leaves and debris in the fall to destroy the hibernating adults and spraying the vines with kerosene emulsion soon after the leaves are fully developed.

APICULTURE.

It is gratifying to be able to report progress in this increasingly important subject. In three of the provinces, namely, Ontario (1906), Quebec (1908), and British Columbia (1911), legislation for the suppression of bee diseases now exists, and officers are being appointed to assist in carrying out the objects of such legislation. The Province of Ontario has a Provincial Apiarist, Mr. Morley Pettit, who is not only carrying on excellent educational work at the Ontario Agricultural College, but is endeavouring to place apiculture on the right basis. In Ontario it is estimated that there are at least 5,000 bee-keepers with an aggregate number of 100,000 hives. Estimates based on crop reports place the total amount of honey produced in the province at 5,000,000 lbs. This, however, does not represent a fourth part of the amount of honey produced in Ontario, which means that millions of pounds of honey are wasted annually.

Apiculture is not only important as a means of producing honey, but is an essential adjunct to fruit growing. No fruit grower should be without several hives of bees at least, as their important function as cross-pollinators is well known, and it has been repeatedly shown that their presence increases the amount of fruit produced. To the farmer who grows alsike and alfalfa they are similarly essential, increasing the amount of seed produced and also yielding honey of excellent quality; in some cases alsike is a failure owing to the absence of bees.

The most serious difficulty in the keeping of bees is the prevalence of two bee diseases. These are known as American and European foul brood respectively, and the legislation which exists has been enacted with a view to the prevention and control of these diseases, both of which are possible. Bee-keepers whose bees show signs of disease, such as the dying of the brood, the sinking and perforation of the cappings, etc., should immediately communicate with the Department of Apiculture of the Province in which they live or with this Division, to which samples of the diseased combs should be sent properly packed in tin or wooden boxes which may be mailed free.

The following advice is given for the benefit of those who contemplate keeping bees:—

Do not begin with too many colonies, one or two hives will be sufficient for the first year.

Obtain your bees from an apiary which is certified free from disease, otherwise it may result in the introduction of disease into new localities.

Have all your colonies in modern frame hives, and do not buy colonies in box hives unless they are to be transferred to frame hives. The Langstroth frame hive is recommended as being the standard hive.

The best time to purchase bees is during May, that is, before the honey flow begins.

It is advisable to consult a neighbouring bee-keeper of experience, if possible, before purchasing the bees and necessary appliances. The benefit of his experience will be of great value and may result in a reduction of the initial expense.

SESSIONAL PAPER No. 16

THE APIARY.

The following is a report on the apiary which is maintained by the Division for experimental purposes. Mr. J. I. Beaulne was placed in charge of the apiary during the summer of 1910.

The bees were taken out of the winter quarters and placed on the summer stands on March 31, 1910. They appeared to be in good condition until an inspection on June 8 revealed the presence of European Foul Brood. This disease was found to be very prevalent throughout the district and across the river in the province of Quebec. All of the thirty-eight colonies were given the 'shaking' treatment for this disease. By this means the bees were shaken off the old combs into clean hives containing new frames with starters, thereby removing all the infected material and compelling the bees to start the building of new combs. The bees are also forced to turn whatever infected honey they contain into wax. A second 'shake' on to full sheets of foundation was given in a few days and the bees immediately drew out the foundation. A number of weak colonies were united, giving twenty-one colonies, of which nineteen were in good condition for the honey flow.

In spite of this set-back, and the drying-up of the white clover caused by the drought between June 8 and July 15, the colonies did remarkably well. About 1,516 lbs. of honey was gathered, yielding over 70 lbs. of honey per hive. The greatest yield for a single colony was 144 lbs. and eight colonies gave an average of over 100 lbs. All the supers were removed on August 27. Between August 28 and September 9, twenty pure Italian queens were introduced in the hope of making the colonies more resistant to disease. Eighteen queens were accepted and began to lay immediately after leaving the introducing cages. By October 1 all the colonies contained large numbers of young Italian bees.

The colonies were brought into winter quarters on November 23 and 24, the average weight being 49½ lbs. At the time of writing (March 31) they are still in winter quarters and have come through the winter excellently so far. The temperature of the bee cellar from November 23 to March 31 varied from 41·80° F. to 45·20 F.; the temperature of the bee cellar should range about 40° to 45° F. not more nor less.



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